



*Rewarding Learning*

**General Certificate of Secondary Education**

**2012**

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**Science: Chemistry**

Paper 2  
Higher Tier

**[G1404]**

**FRIDAY 22 JUNE, AFTERNOON**

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**MARK  
SCHEME**

<b>1 (a) (i)</b>	iron	[1]
	<b>(ii)</b> oxygen	[1]
	<b>(iii)</b> water	[1]
	<b>(iv)</b> gain of oxygen	[1]
	<b>(v)</b> red-brown [1] flaky [1] solid [1]	maximum [2]
<b>(b) (i)</b>	$\text{H}_2 + \text{Cl}_2 \rightarrow 2\text{HCl}$	[3]
	<b>(ii)</b> chlorine gains hydrogen [1] gain of hydrogen is reduction [1]	[2]
	<b>(iii)</b> chlorine: yellow-green [1] hydrogen: colourless [1]	[2]
	<b>(iv)</b> gives out heat	[1]
<b>(c) (i)</b>	thermal [1] decomposition [1]	[2]
	<b>(ii)</b> $\text{CuCO}_3 \rightarrow \text{CuO} + \text{CO}_2$	[2]
	<b>(iii)</b> green [1] to black [1]	[2]
<b>(d) (i)</b>	sulphate	[1]
	<b>(ii)</b> magnesium	[1]
	<b>(iii)</b> $\text{Mg} \rightarrow \text{Mg}^{2+} + 2\text{e}^-$	[3]
	<b>(iv)</b> (copper ions) gain electrons [1] gain of electrons is reduction [1]	[2]

AVAILABLE  
MARKS

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- 2 (a) moles of carbon =  $\frac{72}{12} = 6$  [1]  
moles of hydrogen =  $\frac{13.2}{1} = 13.2$  [1]  
moles of nitrogen =  $\frac{16.8}{14} = 1.2$  [1]  
moles of oxygen =  $\frac{38.4}{16} = 2.4$  [1]  
 $C_5H_{11}NO_2$  or ratio: C:H:N:O = 5:11:1:2 [1] [5]
- (b) (i)  $\frac{20 \times 0.125}{1000}$  [1] = 0.0025 [1] [2]  
(ii)  $\frac{0.0025}{2}$  [1] = 0.00125 [1] [2]  
(iii)  $0.00125 \times 40$  (or  $\frac{0.00125 \times 1000}{25}$ ) [1] = 0.05 [1] [2]  
(iv)  $\frac{3.7}{0.05}$  [1] = 74 [1] [2]  
(v)  $74 - 60 = 14/2 = 7$  [1]  
lithium/ $Li_2CO_3$ /Li [1] [2]
- (c) mass of  $NH_4NO_3 = 2000$  g [1]  
RFM of  $NH_4NO_3 = 80$  [1]  
moles of  $NH_4NO_3 = \frac{2000}{80} = 25$  [1]  
moles of  $N_2O = 25$  [1]  
 $25 \times 24$  [1] =  $600$  [1]  $dm^3$  [6]
- (d) (i) equal volumes of gases [1]  
under the same conditions of temperature and pressure [1]  
contain the same number of particles [1] [3]  
(ii)  $70 \times 2$  [1] =  $140$  [1]  $cm^3$  [2]

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3 (a) (i)

Substance	acid	base	alkali	salt
magnesium chloride				✓ [1]
magnesium hydroxide		✓ [1]		
sodium hydroxide		✓	✓	
	accept either tick for sodium hydroxide [1]			
zinc sulphate				✓ [1]

[4]

(ii)  $2\text{NaOH} + \text{H}_2\text{SO}_4 \rightarrow \text{Na}_2\text{SO}_4 + 2\text{H}_2\text{O}$  [3]

(iii) magnesium nitrate [1]

(iv) contains water [1]  
contains water of crystallisation [2] [2]

(b) (i) pipette [1]

(ii) pink [1] to colourless [1] [2]  
[1] if wrong way round

(iii) remove the indicator [1]

(iv) Individual marks are awarded for correctly labelled and recognisable drawings of assembled apparatus.  
No labels = no marks.evaporating basin [1]  
tripod and gauze [1]  
heat/Bunsen burner [1] [3]

(v) solubility decreases/solution becomes saturated [1]

(vi) any **one** from:  
dry between two sheets of filter paper [1]  
dry in a low temperature oven [1]  
dry in a desiccator [1] [1]

(c) (i) negative ion [1]

(ii) solid [1] appearing when two solutions are mixed [1] [2]

(iii) barium chloride/barium nitrate [1]

(iv) yellow [1]

AVAILABLE  
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- 4 (a) decomposition/breaking down [1]  
of a substance using electricity [1] [2]
- (b) bauxite [1]
- (c) (i) A is anode [1]  
B is cathode [1]  
C casing [1]  
D is (molten) aluminium [1] [4]
- (ii) ions are free to move [1]  
idea that ions are charge carriers [1] [2]
- (iii) 900–1000 °C [1]
- (iv) lower melting point (of aluminium oxide)/increase conductivity [1]
- (v)
- |                 | Positive electrode  | Negative electrode                                       |     |
|-----------------|---|--|-----|
| Name of product | oxygen [1]  | aluminium [1]  | [2] |
| Half equation   | $2\text{O}^{2-} \rightarrow \text{O}_2 + 4\text{e}^-$ [3] | $\text{Al}^{3+} + 3\text{e}^- \rightarrow \text{Al}$ [3] | [6] |
- (vi) electrode: anode [1]  
equation:  $\text{C} + \text{O}_2 \rightarrow \text{CO}_2$  [2]
- (vii) aluminium is tapped off [1] at the bottom of the cell [1]

AVAILABLE  
MARKS

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			AVAILABLE MARKS
<b>5</b>	<p><b>(a)</b> anaerobic (decay) [1] of dead plants and animals [1] over millions of years [1] under the action of (heat and) pressure [1]</p>	maximum [3]	
	<p><b>(b) (i)</b> any <b>two</b> from: creates employment local/cheap fuel supply benefits local economy improved transport links</p>	[2]	
	<p><b>(ii)</b> any <b>two</b> from: eyesore destroys habitats dust pollution noise pollution depletion of resources</p>	[2]	
	<p><b>(c) (i)</b> soluble in water</p>	[1]	
	<p><b>(ii)</b> heating water/evaporate salt solution</p>	[1]	
	<p><b>(iii)</b> subsidence/landslides</p>	[1]	
	<p><b>(d) (i)</b> electrolysis</p>	[1]	
	<p><b>(ii)</b> NaOH</p>	[1]	
	<p><b>(iii)</b> chlorine: bleach/PVC manufacture/water sterilisation [1] hydrogen: rocket fuel/weather balloons [1]</p>	[2]	14

6 (a)

Gas	Test	Result of positive test	
carbon dioxide	bubble into <b>limewater</b> [1]	milky [1]	[2]
hydrogen	apply a lit splint [1]	pop [1]	[2]
hydrogen chloride	glass rod dipped in <b>concentrated ammonia</b> [1]	white [1] smoke [1]	[4]



- (ii) any **two** from:  
 corrodes statues/buildings [1]  
 kills fish [1]  
 kills trees/ vegetation [1] [2]

- (c) (i) correct colour of sugar [1]  
 crystalline [1]  
 solid [1] maximum [2]

- (ii) sugar (initially) goes brown [1]  
 swells/rises up beaker/pillar [1]  
 reaction not immediate [1]  
 heat released [1]  
 caramel smell [1]  
 pungent odour [1]  
 gas/vapour/hisses/bubbles/porous solid/steamy fumes [1]  
 black [1] solid remains maximum [3]

(d) (i)

	Result of a positive test when ammonia solution is added
iron(II) ion	green [1] ppt [1]
iron(III) ion	red-brown/brown [1] ppt [1]

[4]



AVAILABLE MARKS

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- 7 (a) Individual marks are awarded for correctly labelled and recognisable drawings of assembled apparatus which will work.  
No labels = no marks.

reaction vessel [1]

delivery tube [1]

\*sealed system [1]

gas syringe [1]

stopclock [1]

\* = essential mark

maximum [4]

- (b) (i) substance that speeds up [1]  
a (chemical) reaction [1]  
without being used up [1] [3]

- (ii) 1g [1]

(iii)

Industrial Process	Catalyst used	Balanced symbol equation for the catalysed reaction
The Haber Process	iron	$N_2 + 3H_2 \rightarrow 2NH_3$ [3]
The Contact Process	vanadium(V) oxide/ vanadium pentoxide/ $V_2O_5$ [1]	$2SO_2 + O_2 \rightarrow 2SO_3$
Production of Nitric acid	platinum/ rhodium	$4NH_3 + 5O_2 \rightarrow 4NO + 6H_2O$ [3]

- (c) particles gain energy/move faster [1]  
more successful collisions [1]  
in a given period of time/idea of frequency [1] [3]

Quality of written communication [2]

- (d) any **two** from:  
vessels to contain high pressure expensive  
high pressure dangerous/safety  
reduce risk of explosion [2]

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**Total**

**160**